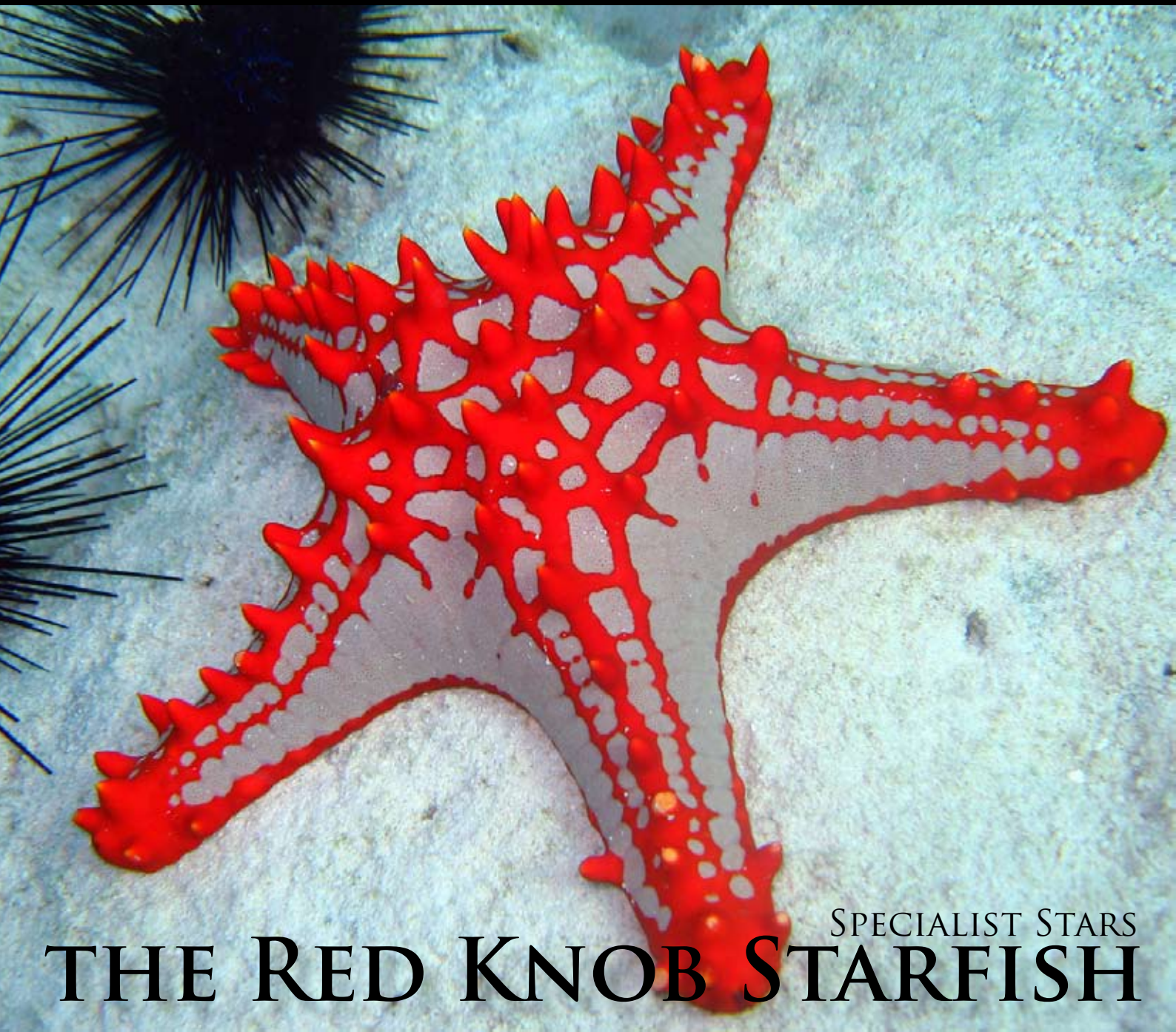
Redfish

April, 2012 (Issue #10)



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Redfish contents

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Two Caribbean Flamingo Tongue Snails (*Cyphona gibbosum*) feeding on a soft-coral (*Plexaura flexuosa*). Photo by Laszlo Ilyes

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This month's Eye Candy Contents Page Photos courtesy:

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'Tarpon' by Ines Hegedus-Garcia
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(Bottom row. Left to Right)
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'Untitled' by Keith Bellvay
'Clownfish' by Erica Breetoe
'Yellow Watchman Goby' by Clay van Schalkwijk
'Horned Viper' by Paul Albertella





About Redfish

Redfish is a free-to-read magazine
for fishkeeping enthusiasts.

At Redfish we believe in the free exchange of information to facilitate success by aquarium and pond hobbyists. Each month Redfish Magazine will bring you dedicated sections on tropical, coldwater, marine and ponds.

Redfish was founded in early 2011 by Jessica Drake, Nicole Sawyer, Julian Corlet and David Midgley.

We hope you enjoy this, the tenth issue of Redfish.

古池や蛙飛込む水の音
ふるいけやかわずとびこむみずのおと

Photo courtesy: (matt)

The Fine Print
Redfish Magazine

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Pseudotropheus fla vus

Photo by Budi Lukman

it's all fun and games until someone gets hurt

It's one of those fish that catch your eye. You know what I mean. You're wandering through the local aquarium, looking at new stock and there it is, small - brilliantly coloured - and feisty. With its black and yellow banding, *Pseudotropheus flavus* is a favourite amongst African cichlid hobbyists - but like all cichlids, beginners should pause before purchase - this isn't a fish to mix with your tetras. Cichlids are regarded by many hobbyists as aggressive and fish like *P. flavus* are part of the reason for this reputation. So what do you need to know before you embark on the rollercoaster that is cichlid ownership with respect to this little fish?

In many respects, *P. flavus* is a typical Malawi mouthbrooding cichlid. It's only the males that are colourful - and typically it's the males that are most aggressive. Like almost all of the species in the "mbuna" (rock-dwelling fishes of Lake Malawi) the species is primarily vegetarian and relishes plant material in most forms and like all Malawi cichlids - the species requires hard, alkaline water. These latter points, particularly the need for hard alkaline water - but also their plant-destroying habits, dictates that Malawi cichlids should only really be kept with other fishes endemic to this region.

Unlike many cichlids from Lake Malawi which have widespread distributions, *P. flavus* has a very restricted distribution, being found pretty much exclusively around Chinyankwazi Island, a tiny island north northeast of Monkey bay. The species occurs in relatively shallow water down to about 20 metres.

chinyankwazi island is a tiny rocky outcropping north-northeast of monkey bay in the south of lake malawi.

the main street in monkey bay. photo by brian dell

In the aquarium, *Pseudotropheus flavus* - like virtually all mbuna are straightforward to keep provided some guidelines are followed.

Aquarium setup:

Physicochemical chacteristics

- pH: 7.5-8.5
- EC: 210-220
- Alkalinity ($CaCO_3$ (mg/L)): 123
- Water movement: slow
- Temperature: 23-28° C
- Volume: 150-200 litres.

Substrate

The colour of substrate is unimportant, however, in the authors opinion darker substrates generally improve the contrast of colours in the fish. That aside, substrate should be calcite in some form. Shell grit, coral sand and crushed marble are all acceptable and will keep pH at the appropriate level.

Décor

The aquarium should be decorated with numerous caves and hiding places. Show tanks for these species are typically decorated with large rocks piled into a freshwater ''reef''. See the lovely example below photographed by Lee Nachtigal. Alternative decorations include dead coral skeletons and sea shells with actinic lighting, this faux-marine look is popular with some aquarists and is someones seen in businesses where the look and colour of a marine tank is desired without some of the complications that arise with salt water. For the aquarist interested in breeding these fishes rather than displaying, stacked rows of inverted terracotta pots (each with an entrance cut into the side) provide a cheaper, lighter and more easily manipulated alternative.

Stocking

In a 180 litre (55gal) aquarium one could comfortably maintain a group of 12-16 flavus. The group should include 2-3 males and the remainder as females. Bristlenose catfish and sucking loaches (Chinese algae eaters) can be included to assist with algae clean up.

Breeding

Breeding *P. flavus* is straightforward and does not require much intervention. Females carry the eggs and fry in their mouths for around 3 weeks. Once it becomes obvious to the aquarist that a female is mouthbrooding fry she should be moved to a ''fry saver'' - a floating container with netted vents to allow water in and out. Once the fry are large enough they should be removed to a grow out tank where they can be easily raised on crushed flake foods. The female should then be allowed to recover for 1-2 weeks (they don't eat while mouthbrooding) before being returned to the aquarium.

P. flavus is a striking cichlid that's well worth a try if you've got a bit if experience.

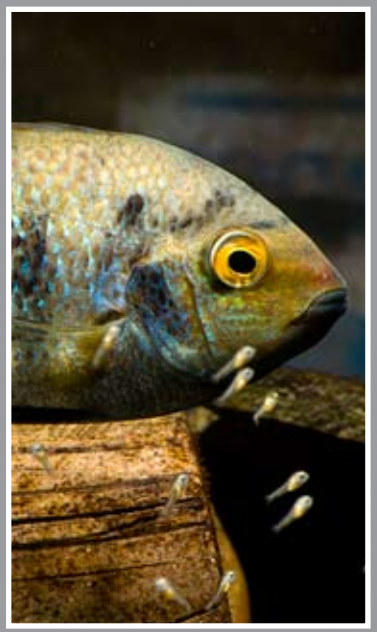
the mbuna aquarium should be decorated with large rocks. photo by lee nachtigal

Today In The Fishroom

with Mo Devlin

Paratheraps sp. "Coatzacoalcos"

a variant from the Rio Carolina, *P.* "Coatzacoalcos" is a beautifully patterned species .

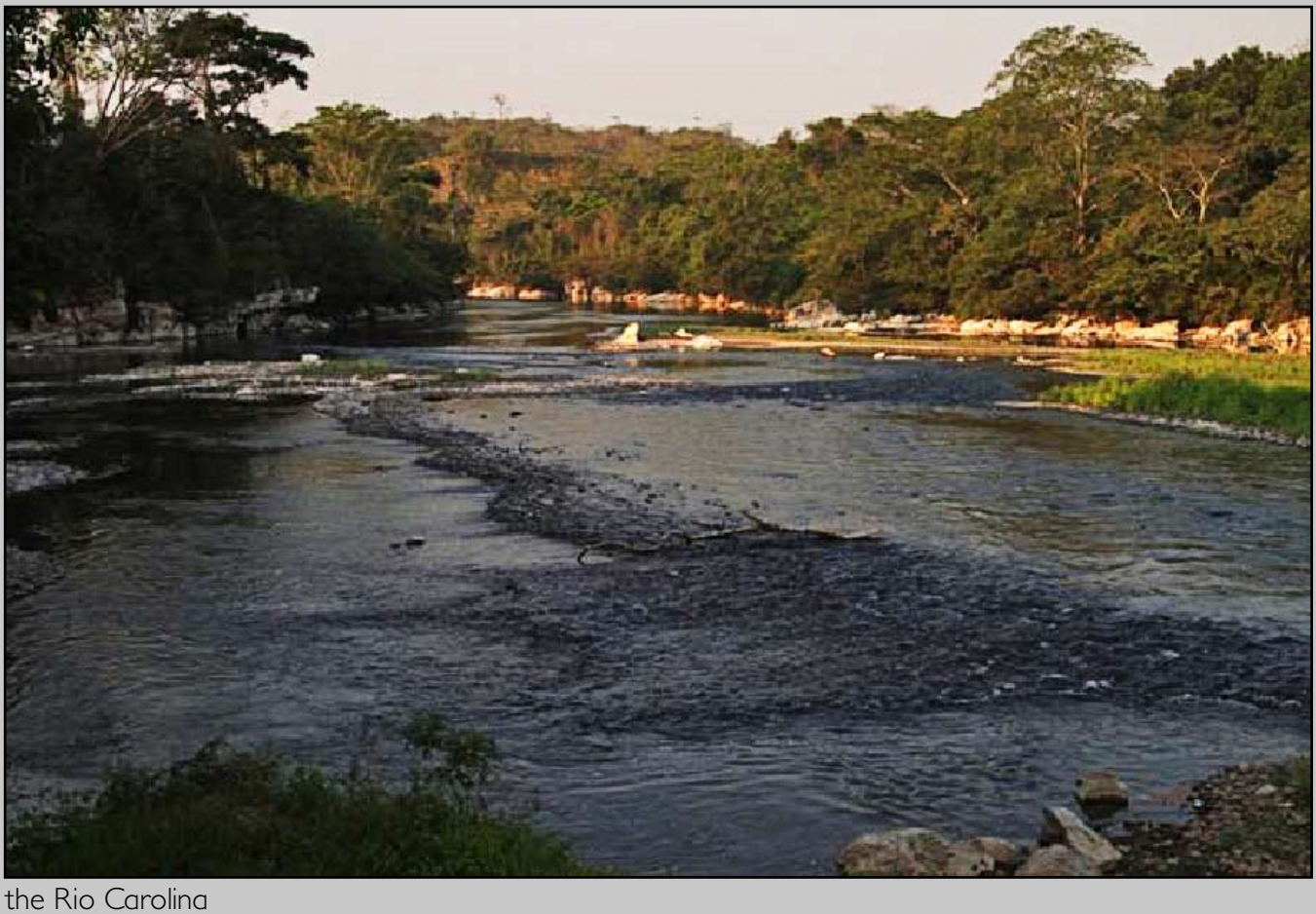


Coatzacoalcos

Text and photos by Mo Devlin

A good deal of my Central American cichlids are wild caught fish. I either collected them myself or acquired them through one of friends. I've been very fortunate that my circle of friends include some well known aquarists that have traveled the globe collecting and exploring. One such friend is Rusty Wessel. Rusty is well known to many in the hobby and I have been fortunate to go on several collecting trips in his company. His knowledge and experience have made for many memorable adventures and stories. My acquisition of the very beautiful *Paratheraps* sp. "Coatzacoalcos" is one of them, but not one that originated in the field.

At the 2010 ACA Convention in Milwaukee, Rusty said he brought along some "Coatz" for my collection. I said, "Great. Let's go get them". As luck would have it, at that very moment we were hit with a severe storm warning for a possible tornado. The alarm in the hotel was sounding and everyone was headed for the storm shelter. Everyone except Rusty and I that is. We were headed in the opposite direction, against the flow of traffic, back to his room where I was going to collect my fish. Windows were rattling violently along the hallway as the storm raged as we



the Rio Carolina

walked back. For a fleeting moment I wondered if I would be swept up and sucked out a window only to be found a half mile away in a field with a bag of fish in my hand. It's the only fish I ever obtained in the midst of a tornado.

The name 'Coatzacoalcos' refers to the range of the species in the Coatzacoalcos river system in the Tehuantepec isthmus in Mexico. The fish has not been officially described. Most often it is confused with *Paratheraps zonatus*, another very beautiful blue fish, and mistakenly sold as "Red Tail Zonatus" due to the coloration in the caudal fin. In fact, many people who think they have zonatus are likely to have one of the local variations of *P.* sp. "Coatzacoalcos".

The fish that are in my tank are a variant that were collected in the Rio Carolina. This river is quite isolated and somewhat remote from the larger populations that exist in most of Mexico. In addition to the "Coatz" cichlid, also inhabiting the Rio Carolina are Regani, Bulleri, *Thoricthys mixteco* sp. and *Thoricthys callolepis*.

As you would imagine, various collection locales will produce similar species of fish with a variety of color differences. Coatzacoalcos is no differ-

ent, even within siblings from the same area. As my fish matured I noted that one in particular was much larger and more blue color intense than the others. I automatically assumed that it was the male and the rest female. I later found out that I had two or three other males that, while more colorful than the normally drab female, did not present the overall striking blue of this one male. After inquiring with some other aquarists online I discovered that it wasn't unusual to have one or two fish with dramatically different coloration. Perhaps it is a dominance indicator. I don't know for sure. The female fish, while not as colorful, still present very interesting patterns.

Spawning pairs in the wild generally have a bright yellow coloration. Unfortunately this has not happened in my aquariums. And from what I have gathered through other peoples experience this is not uncommon. Like most of the Central American cichlids, breeding brings out not only the color but the behavior that make keeping and photographing them interesting and fun. The Coatz were no exception, offering a dramatic switch from solids to strong vertical barring on a high contrasting background.

One thing you can always count on with Central American cichlids is that their aggression

is always there and never more "tuned in" as during the breeding process. When Rusty gave me the fish, the one piece of advice he imparted was, "when these fish pair, you have to separate the pair because they will kill the other fish in the tank". And he was spot on. I had separated the dozen fish I had into three separate 450 litre tanks. Shortly after the fish reached a length of 10 cm a pair formed in one of the tanks. As these things often do, it happened when I wasn't in front of the tank. The result was a tank that

ABOUT THE AUTHOR

Mo Devlin is the owner of Aquamojo.Com. He maintains three thousand gallons of fresh water tanks. Over his thirty years in the hobby he has successfully bred many of the Central and South American cichlid fishes.
His passion for New World cichlids is only rivaled by his love of photography. Over the years, he has posted images of his collection frequently in his "Today in the Fishroom" series on line across many national and international fish forums. Mo has spent two terms on the board of trustees for the American Cichlid Assn, was chairman of the organization in 2010, and has been the Publicity chairman for the past decade.

went from a population of four to two....male and female. After a few successful spawning while juveniles, the male turned on the female. Now the tank had a population of one.

I'm very familiar with large aggressive fish and the challenges that come with breeding. Several years ago I designed a very good divider for protecting breeding fish from the mutual aggression. Under normal circumstances I would keep the tank divided and allow a passage for the female to pass through to access the male's side. Because there is little difference in the size between the male and female right now, I opted for the next best thing. Even though the pair bred once or twice successfully while much younger I thought it necessary to install a complete divider... just to be safe. The female immediately started cleaning a breeding area in an upturned pot next to the divider. The male remained attentive. As has happened many times in the past the pair will have no problem breeding through the divider.

One of my long standing "rules" in the fishroom is that if the fish isn't breeding or posing for the camera, they're moved out of their home for fish that will. These lovely *P.* sp. "Coatzacoalcos" never fail to provide me with plenty of quality photos and lots of fry for distribution in the hobby.

If you would like to see more photos of this fish, you can visit my gallery at: http://goo.gl/LMYFE or visit the Aquamojo Face Book page at: http://www.facebook.com/aquamojo. As always, if you have any questions or comments you can e-mail me at aquamojo@modevlin.com.

photo by Khantipol

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Surgeonfishes

Tangs, Unicorns & their kin

by Aaron Sewell

Photo by Christian Jensen

Despite being highly sought after by aquarists, surgeonfishes of the family Acanthuridae are not always an ideal choice for the home aquarium. Although not a large family with around 80 species, the surgeonfishes are well represented in the trade with members of 5 of the 6 genera being commonly offered to aquarists. Both the common name "surgeonfish" and scientific name "Acanthuridae" relate to the spines located on the caudal peduncle, the fleshy part at the base of the tail. The common name relates to the spines in the type genus, *Acanthurus*, being scalpel like, while the scientific name translated from Greek means thorn tail or spine tail from the Greek words 'akanthus' meaning spine and 'uro' meaning tail.

The family is divided into 3 subfamilies based on the differences in the caudal peduncle spines.

- Acanthurinae
- Nasinae
- Prionurinae

The Acanthurinae, which consist of the genera *Acanthurus*, *Paracanthurus*, *Ctenochaetus* and *Zebrasoma*, have retractable spines that emerge from grooves in the peduncle as the tail flexes. As the tail moves to the left, the spines on the right are exposed and vice versa. Members of the subfamily Nasinae have fixed spines that are hooked forwards often in pairs while those from the subfamily Prionurinae have fixed spines that sit perpendicular to the peduncle, giving them the common name Sawtail Tangs.

Doctorfish (*Acanthurus chirurgus*) from subfamily Acanthurinae. Photo by Brian Gratwicke

The unusual Humpback Unicornfish (*Naso brachycentron*) from subfamily Nasinae.

a school of Razor Surgeonfish (*Prionurus laticlavius*) from subfamily Prionurinae. Photo by Laszlo Ilyes.

the iconic, and rather beautiful, Blue Tang (*Paracanthurus hepatus*) confusingly shares its common name with the less commonly encountered species *Acanthurus coeruleus* (below right).

Surgeonfishes are mostly omnivores tending towards herbivores though some, particularly those from the genera *Naso* and *Paracanthurus*, have life stages that are predominantly planktivores. In the aquarium, most species will graze on filamentous algae but will, in most cases, readily accept meaty foods such as brine or mysis shrimp or even pieces of prawn or fish. Along with rabbitfishes and blennies, surgeonfishes are the most commonly purchased fish to combat nuisance algae though different species are better suited to different algae problems. *Zebrasoma* spp. tend to be ideal when diatoms are present though they also make

the other blue tang (*Ancanthurus coeruleus*). Photo by Brian Gratwicke.






A selection of species from the subfamily Acanthuridae. Top left: Sohal Tang (*Acanthurus sohal*). Top right: Orangespine unicornfish or Naso tang (*Naso lituratus*). Centre left: Powder Blue Tang (*Acanthurus leucosternon*). Centre right: Orangespot Surgeonfish (*Acanthurus olivaceus*). Photo by Brian Gratwicke. Bottom left: Chocolate Tang (*Acanthurus pyroferus*). Photo by Brian Gratwicke. Bottom right: Yellow Tang (*Zebrasoma flavescens*) by Laszlo Ilyes.

short work of green filamentous algae. *Ctenochaetus* spp. are the most suitable when only filamentous algae is present while *Acanthurus* spp. are ideal for eliminating macro algae such as *Caulerpa* if it becomes problematic. It is advisable to offer sheets of nori to surgeonfish to supplement their diet and allow them to graze throughout the day.

In general surgeonfish are both large and active fish meaning they require a relatively large aquarium to be maintained long term. While some species such as the Convict Surgeonfish (*Acanthurus triostegus*) and Scopas Tang (*Zebrasoma scopas*) reach lengths of only around 15cm, some of the larger unicornfishes (*Naso* spp.) may reach upwards of 60cm. Species from the genera *Ctenochaetus* and *Zebrasoma* are generally the least active, preferring to linger around areas where food supplies are good and casually grazing.

On the other hand those from the genus *Acanthurus* are the most active, travelling in large shoals, quickly decimating small areas of algae before moving on to another area. In the aquarium, this means *Acanthurus* aswell as the monospecific *Paracanthurus hepatus* (Pacific Blue Tang) tend to require larger aquariums than similar sized (based on full adult size) species from other genera.

the Scopas Tang (*Zebrasoma scopas*) is very poopular with aquarists and despite being a more subtlely coloured fish it has beautiful patterning on its flanks. It's also ideally sized, growing only ~15cm in length. Photo by William Warby.

The Convict Tang, also known as the Manini, (*Acanthurus triostegus*) is found in the wild in massive schools , often they number several hundred fish. In the aquarium, the species is comparatively well-suited, being one of the smaller growing surgonfishes and being relatively placid. The species (like almost all surgeonfishes) is herbivorous.

Despite being predominantly herbivorous, surgeonfishes are notoriously aggressive fish. On the reef, surgeonfishes (with the exception of *Naso* spp.) form large shoals moving around feeding grounds aggressively chasing away competitors (including other surgeonfishes). So while surgeonfishes are not technically territorial, instead travelling over vast ranges seeking ideal feeding grounds, in the aquarium, their aggression is similar to that of highly territorial fishes due to the fact their feeding grounds are so restricted. Because of this, unless the aquarium is very large, surgeonfishes of different species are not particularly compatible. This problem is exacerbated if the body shapes and/or colours of surgeonfishes being kept together are similar. Unlike most fish that attach by biting, surgeonfishes use the spines on the caudal peduncle meaning they can use their speed to dart back and forth taunting other fish with an occasional passing strike. This harassment of other fish can be highly stressful and while

ABOUT THE AUTHOR

Aaron Sewell

In 2004 Aaron completed a BSc (Marine Science) at the University of Sydney with majors in marine biology and tropical marine science. Since 2001 he has been involved with the aquarium industry at hobbyist and retail level and now works in aquarium product development. Aaron is a former committee member of the Marine Aquarium Society of Sydney and has collected fish and corals in Fiji for the US and European aquarium industries. Aaron has been writing for several local and international aquarium magazines since 2004.

The Powder Blue Tang (*Acanthurus leucosternon*) is very popular in the aquarium hobby and, at least on some levels, is reasonably well-suited to the aquarium. The species is, however, extremely prone to infection by *Cryptocaryon irritans* (shown above). Treatment of marine ich can be problematic in reef aquariums, where the use of many medications is precluded.

if you're keen on macro algae - there are species of *Caulerpa* that grow at a moderate pace. This is *Caulerpa sertularioides* growing in the wild. Surgeonfish will eliminate these algae in aquariums. This can be good or bad depending on your perspective.

it is uncommon for surgeonfish to kill tankmates outright, the repercussions due to stress or infected injuries can be fatal. Surgeonfishes are also highly prone to disease and infection. They become easily stressed, especially during transport and subsequent acclimation and acclimatisation where it is not uncommon for them to pick up diseases such as marine ich (whitespot). Surgeonfishes are commonly referred to as "whitespot magnets" due to their high susceptibility to these pathogens but it is possible to minimise the risks of infection by quarantining all fish prior to being introduced to the aquarium. The risk can never be eliminated but reasonable treatment such as hyposalinity during quarantine can increase the chances of survival through the critical period of 8-12 weeks substantially. After the initial period when the

Caulerpa taxifolia can overgrow aquariums.

An attratcive *Caulerpa*, *C.racemosa* var *clavifera*

stress of transport and acclimation are no longer present, surgeonfish can become extremely hardy fish. This period is often also highlighted by a refusal to feed. Many surgeonfishes will graze on benthic algae but refuse prepared foods during the acclimation period. Given that aquarists attempt to eliminate any visible algae within the aquariums, this can lead to insufficient food for the fish and can be fatal. After the acclimation period however, surgeonfish often become bold, boisterous and even aggressive feeders.

While surgeonfishes make excellent additions to large marine aquariums with respect to their colours and highly active behaviours, there are certainly some drawbacks that should be considered both when deciding whether to purchase a surgeonfish and deciding which species to add to the aquarium. Consider the maximum size the individual may achieve; often the 5-7cm individual that looks perfect for a 200 or 300L aquarium may reach 20cm within 3 years and potentially 40cm or more within 5-7 years. While surgeonfishes are generally long lived (30-50 years), they have an exceptional growth curve that sees them reach 90% of their maximum size in just 10% of their life. Consider what other fish will be kept in the aquarium. Surgeonfishes will generally do well with small peaceful fish or large predatory fish but considerations should be made with regard to any species such as other surgeonfish or rabbitfish, which may be regarded as competition. Finally, consider the introduction process, keeping in mind that quarantine and disease prevention methods will immensely increase the chances of having one of these fish in your aquarium for many years to come.

Lined Surgeonfish (*Acanthurus lineatus*)

Kole Tang (*Ctenochaetus striatus*)
Photo by Carl Malamud

Tomini Surgeonfish (*Ctenochaetus tominiensis*)
Photo by Brian Gratwicke

Red Sea Sailfin Tang (*Zebrasoma desjardinii*)

the Sohal Surgeonfish (*Acanthurus sohal*) is endemic to the Red Sea. A truely magnificent fish, it is probably best left to specialists in large marine species with suitably sized aquariums. Individuals will eventually reach 40cm (15") and can be very aggressive. Like all Surgeonfish, it requires a diet rich in marine plants/algae to remain healthy.

Horned STARFISH

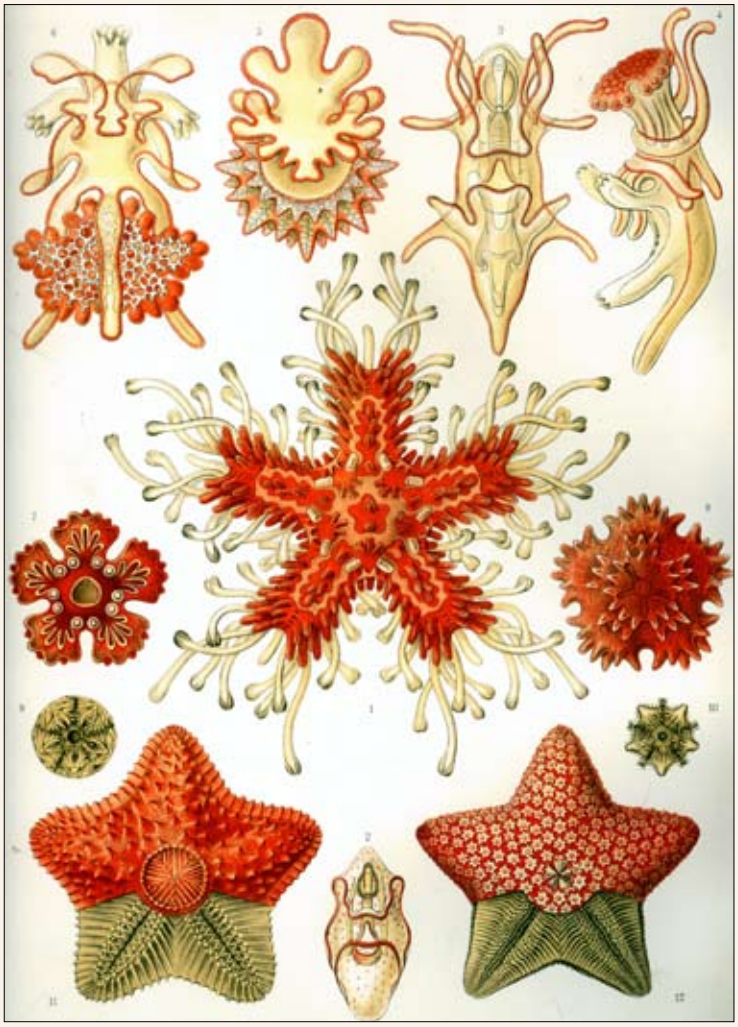
In many ways starfish epitomise the sea. No species live away from the marine habitat and their unusual radial symmetry marks them as iconic choices for the marine aquarist.

Biology

Starfish belong to phylum Echinodermata - a high-level biological grouping they share with the sea urchins, brittle-stars and sea cucumbers. The phylum is the largest to not contain representatives in either freshwater or terrestrial habitats.

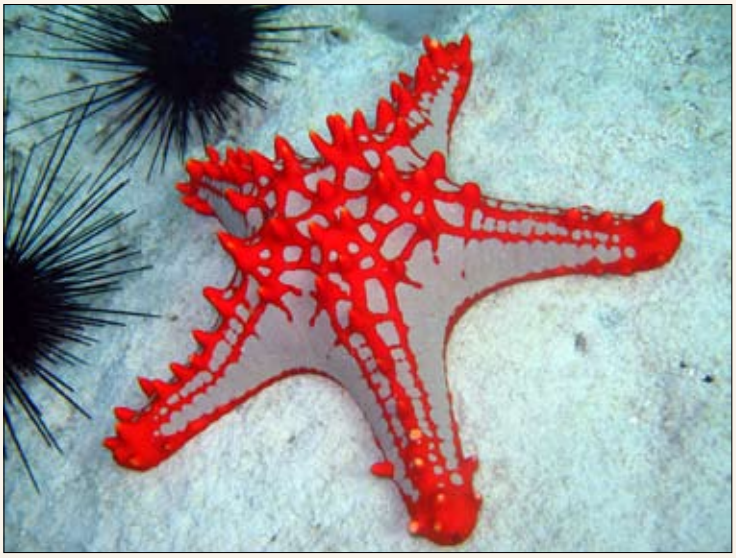
Within this phylum, starfishes (also known by some as sea stars) all fall into a single biological class, the Asteroidea. In total, there's just shy of 2000 living species of starfish and as a group they have a global distribution - occurring in all marine habiats from the intertidal zones down to the abyssaal depths (at 6000 m below sea level!).

The radial symmetry of starfish makes them instantly recognisable, and many species can (as childhood tales tell) regrow lost arms. The marine aquarium hobby features relatively few starfish species - and most species aren't well suited to captive care.



Common starfish drawn in beautiful detail by the German naturalist Ernst Haeckel in 1904 in his iconic work: Kunstformen der Natur ("Art Forms of Nature").

Horned Starfish



The Red Knob Starfish (*Protoreaster linckii*) requires similar care to the Chocolate Chip Starfish.

Chocolate Chip Starfish (*Protoreaster nodosus*) come in a range of base colours although the "chips" are normally brown-to-black. Bottom photo by punctuated@flickr.com

Within the group known as the Horned Starfish, one genus (*Protoreaster*) is commonly available - with two species being normally traded: the Chocolate Chip Starfish (*Protoreaster nodosus*) and the Red Knob Starfish (*Protoreaster linckii*). Both of these species are also collected and dried, only to be sold as keepsakes for tourists, a fairly sad and pointless process in the opinion of this author. In addition, a second genus (*Pentaceraster*) is also sometimes available and superficially similar to the more commonly traded *Protoreaster* species. In terms of care, which we'll cover below, both genera are broadly similar. All species mentioned above typically inhabit relatively slow moving water and are often found in shallow tidal areas or in sandy or muddy lagoons. Some of the Horned Starfish will emerge from the water onto algae-covered rocks to feed. Most of these species grow to 15cm (6") in diameter in the wild and should also do so in captivity if provided with appropriate care.

The care of these species by hobbyists (and the advice given by some traders of these animals) can be highly varied and ranges from excellent to fanciful. The truth is, one should never buy a starfish on a whim - indeed, it's an animal you really need to build your aquarium around. The reasons for this can be covered in a few relatively short points:

- **Sensitivity to water quality.** Horned Starfish (indeed all echinoderms) are highly sensitive to water quality. They are intolerant of nitrates or phosphates and quickly loss health with an excess of either of these nutrients. As an aside, it's been hypothesised that this sensitiv-

ity has to do with their water vascular systems (their bodies are literally full of salt water).

- **Diet.** All Horned Starfish are opportunistic predators who, in their grazing of biofilms -- at least in aquariums -- will readily consumed sessile invertebrates they come into conatct with. This includes corals, anemones, feather-dusters, molluscs (including most snails) and even fish if they are particularly slow. They'll also eat other starfish - so the recommendation is for one per tank.

Taken together, these two key points should highlight why aquarists have so much trouble with starfish. That is: they'd die very quickly in a fish only (FO) aquarium and they'd decimate corals and other sessile inverts in a reef aquarium.

So what's the solution? FO aquariums arent going to work, reef aquariums arent going to work - in this case an aquarium with fish only and liverock and fish is the solution (called FOWLR aquariums, for obvious reasons). Further, an aquarium that features sea grasses or macro-algae beds would also be a good choice. Finally, on the issue of tank design/setup it is also worth noting that starfish (for reasons associated with the first point above) make poor additions to new aquariums and should only be added to stable, well-aged and cycled FOWLR systems.

There are some mobile invertebrates you can probably keep with starfish in such a FOWLR system, but keep in mind the needs of both. Some shrimps (such as the Harlequin shrimps) are predators of starfish and make poor choices for this reason,

a *Pentaceraster* species from Tanzania.
Photo by Paul Shaffner.

a *Pentaceraster* species from Tanzania.
Photo by Paul Shaffner.

Panamic Cushion Star (*Pentaceraster cumingi*) in Panama.
Photo by Laszlo Ilyes.

conversely, other invertebrates need to be able to move quickly enough not to be eaten by the starfish. It's a bit of a tricky situation and careful consultation with other hobbyists and a reputable aquarium store should be able to offer sound advice. Non-grazing, non-invert eating fishes (for example, most eels) would be fine tankmates that wouldn't bother the starfish or its food source. Certainly, all impulse purchases should be discounted and avoided.

Given the right environment, starfish like the Horned Starfish can make excellent pets - but you need to be aware of their unique needs and the limitations their presence imposes on heterospecifics.

a The Red Knob Starfish (*Protoreaster linckii*) emerges from the water at Lazy Lagoon, near Bagamoyo, Tanzania.
Photo by Paul Shaffner

Feeding Corals

By Sara Allyn Mavinkurve

In General

There seems to be a persistent myth spread among reef aquarists (at least those in the USA) that corals don't really need food. The myth is that they only need light. Thus, before I talk about how to feed corals, I would like to establish the fact that corals do in fact feed on food and don't rely on light alone for their energy and nutrient needs. One of the main reasons corals are considered animals (as opposed to plants or algae) is because they are heterotrophs. By definition, all heterotrophs feed on other organisms. The fact that corals are indeed heterotrophs necessitates that they feed on other organisms either directly or indirectly. This is a well known and established fact among marine biologists and ecologists (and anyone who might study coral as a scientist). If you're not convinced, I invite you to take a look at some of the references listed at the end of this article. I've only listed a few of the hundreds available. A few of these articles discuss studies in which corals were kept in the dark for several weeks. In these studies, the corals which were fed did not suffer tissue loss. The ones which weren't fed did suffer tissue loss. When deprived of light but provided with food, large-polyp corals lasted longer than small-polyp corals. More recent studies provide evidence that a coral's ability to feed enables it to survive episodes of bleaching.

Despite all the evidence that corals need food, over the years, I've met several reef aquarists who still insist that corals (especially "SPS corals") don't need to feed. Granted, it may be true that you don't need to specifically and/or directly feed your corals, but they do need to get food from somewhere. This food can come in the form of left over fish food, fish waste, and/or zooplankton in your own system's water column. Corals feed on living organisms as well as on non-living suitable organic particulate matter. One example of zooplankton which feed corals, which might be in your water column, is "veligers" (a certain life cycle stage of gastropods). Specifically which kinds of zooplankton and what type of organic particulate any given coral will consume varies widely. In other words, every coral is different when it comes to what they can/will consume as food. Some feed more on detrital particulate organic matter while others consume more active prey. Many corals will consume specific kinds of both. What a coral

Zoanthids aren't technically corals - but require similar feeding and are generally hardier.

Tubastrea corals are non-photosynthetic and require dedicated feeding.

Polyps actively seeking food.

feeds on can also depend on their environment. Potential environmental factors include relative availability of different kinds of food, as well as the nature of the water flow around the coral.

Back in the 70s, a coral reef scientist by the name of JW Porter described two types of scleractinian corals; "light specialists" (in general, commonly known as "SPS") and zooplankton capture specialists (in general, commonly known as "LPS"). Simply put, those corals which are thought to be most adept at utilizing light and photosynthesis for their energy needs would be called "light specialists." Corals which are more adept at capturing food would be called "zooplankton capture specialists." Porter hypothesized that there might be a relationship between the ratio of the total surface area of the coral and the total volume of the coral and how much that coral relied on light for energy. Porter hypothesized that corals with a greater surface area to volume ratio would, theoretically, be more likely to be light specialists. The theory makes sense if you think of the shape of anything that utilizes light to make energy (organic or even man-made). In other words, a flat panel is better for utilizing light than a sphere. However, another biologist, KP Sebens, hypothesized that this ratio (surface area: volume) has more to do with prey capture than with utilization of light. Sebens reasoned that the more surface area, and the smaller the polyps, the more polyps there are to capture zooplankton. This also seems to make sense. The more mouths you have, the more food you can eat, right? There's evidence to support both theories. In any event, one thing is for sure: while there are corals which can survive without light, no coral can survive and grow without food.

How do you know if your coral is getting enough of the right kind of food?

Well, if its growth is obvious over a few months, it's likely getting the minimum of whatever it needs.

Large polyp stony (LPS) corals, like this *Euphyllia* sp,., are specialists in zooplankton capture . In broad terms, LPS corals are less adept at using light than the small polyp types. This knowledge not only helps with feeding, but also in positioning your corals within the aquarium.

Some signs that your corals are not getting enough food are; 1) slow or nonexistent growth (even if the coral otherwise seems healthy, if it's not growing, it could be starving), 2) slow tissue recession which can't be attributed to another cause (such as poor water quality or predatory fish). Below are some tips on how to feed your corals.

Feeding Light-Specialists

Unfortunately, you can't go to your local fish store and buy a jar of veligers. Thus, the best way to feed your light-specialists it to; 1) encourage growth of "critters" of various kinds and hope that some life stage of something will suffice as food for your coral, and 2) use fish food that's been blended to a pulp and consequently contains very small organic particulate matter (such as Rod's Food in the USA).

Feeding Zooplankton Specialists

Naturally, feeding the zooplankton-specialists is often easier. Since they are designed for prey capture, all you usually have to do is make sure the food gets to them. Don't try to feed your coral the largest possible thing you think it can consume (ex. don't feed a whole silverside to a Bubble

Coral). I can probably fit an entire nectarine in my mouth, but why would I want to? Your corals aren't entering any competitive eating contests, so you can/should feed them smaller pieces.

Soft Corals

Almost all soft corals have relatively rapid growth rates in most reef aquariums (compared to stony corals). Thus, I imagine they must be easy to feed without even trying to do so.

Recipe for Reef Aquarium All-in-One Food

Many reef aquarists like to make their own food. This allows one to customize the food for their particular tank's needs. It's also usually cheaper than buying pre-made foods. However, it does get messy (not to mention that blending, soaking, mincing and mashing a variety of seafoods can result in a lingering aroma). It can also be a bit time consuming.

In any case, if you do decide to try your hand at reef tank food preparation, you'll want to prepare a frozen mix of various aquarium foods and seafoods cut, chomped, mashed and minced to varies sizes and consistencies (depending on your livestock's needs). Here are some ingredients to consider:

Examples from the grocery store:

- fresh or frozen shrimp (please try to find trap-caught)
- urchin roe
- canned caviar
- fresh or frozen squid and/or octopus
- fresh or frozen scallops, clams, oysters and other bivalves

Fresh is best. Avoid canned or frozen foods with lots of salt and/or preservatives. If you can find "organic," that would be preferred.

Always rinse all these foods with filtered water. Even if they are fresh/organic, they can be coated in phosphates.

Examples from your LFS:

- oyster and/or shrimp eggs
- cyclopeeze
- frozen baby brine shrimp
- frozen adult brine shrimp (enriched if available)
- frozen mysid shrimp
- frozen chopped mussls, squid, etc

Example dry foods:

- Nori and other dried seaweed (for any veggie eating fish)
- quality marine fish food (such as Spectrum)
- dry cyclopeeze (frozen is better)

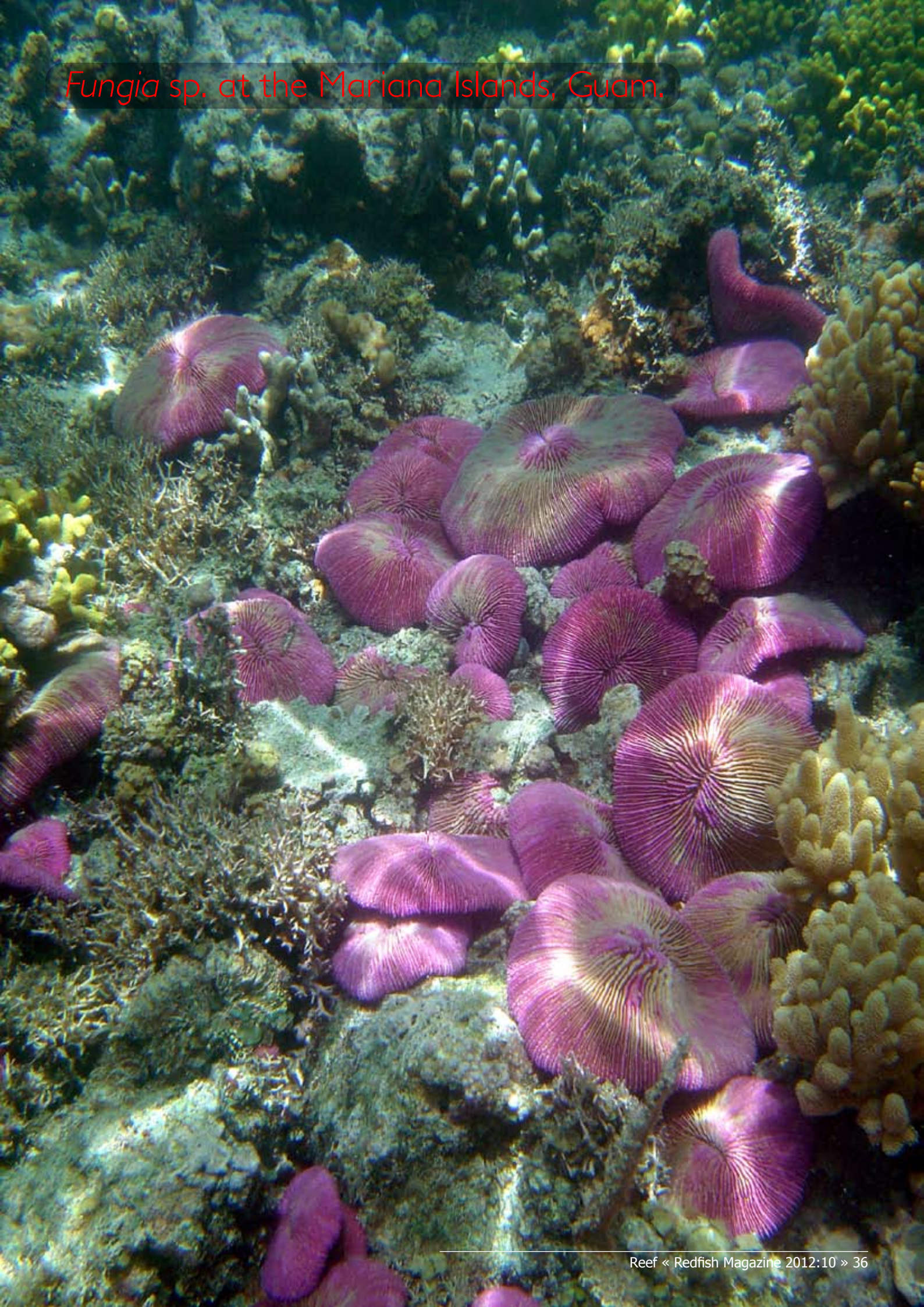
It's not a bad idea to soak the dry foods in the juices of the frozen foods.

Prepared Foods

There are some good prepared mixed foods available. However, be careful to know what exactly is in these foods before putting them into your tank. Don't buy any food or additive that does not list all its ingredients. In my experience, some products claiming to be "coral food" are actually useless for feeding corals. I remember one in particular, which I saw in a local fish store a few years ago, with an ingredient list that read more like a recipe for salad dressing than anything else.

Phytoplankton

Phytoplankton is made up of microscopic plants. It is the base of the food chain for virtually all life in the ocean. Though most corals do not directly feed on phytoplankton, as mentioned previously, the larvae of many reef tank critters do. It's fairly easy to culture your own phytoplankton if you have the space. Alternatively, there are several refrigerated phytoplankton products available. Keep in mind that substantially fewer organisms will feed on dead phytoplankton than will feed on live phytoplankton. So when considering the purchase of a phytoplankton product, keep in mind that any phytoplankton that is sold frozen is dead (since freezing inevitably kills the phytoplankton cells). Some phytoplankton products sold refrigerated (but not frozen) are alive and some are not. Some species of phytoplankton known to survive refrigeration are *Nannochloropsis oculata*, *Phaeodactylum tricornutum* and *Chlorella*. Note that the commonly sold *Isochrysis galbana*, does not survive refrigeration.



Fungia sp. at the Mariana Islands, Guam.

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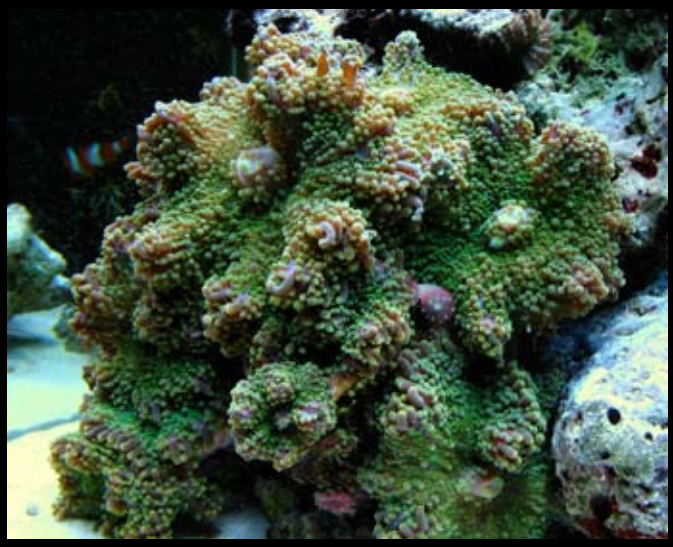
Madracis mirabilis, a member of the Pocilloporidae, feeds 24hrs a day.

Trachyphyllia geoffroyi has short feeding tentacles and lacks much combative ability (so don't place it near particularly aggressive species).



the Coral-relatives from the Corallimopharia such as this colony of mushrooms are generally heavy feeders. Mostly they eat smaller prey items or obtain nutrients via absorption. Larger tentacled types, such as Elephant Ears are, however, capable of eating larger prey items.

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Australian Koi Association
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Koi Society of WA
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Queensland Cichlid Group
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Brisbane Aquatic Plant Study Group
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Corkboard courtesy: Christian Guthier

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